

WHAT IS CLAIMED IS:

1. A disk drive apparatus with a spindle motor which rotates a disk medium, comprising:

a motor driver configured to supply a current to the spindle motor to drive the spindle motor;

a temperature sensor configured to measure a temperature of the spindle motor;

a disk controller connected to a host system which uses the disk drive apparatus, the disk controller providing an interface control function which controls data communication between the host system and the disk drive apparatus; and

a CPU configured to control activation of the spindle motor using the motor driver, the CPU setting, in the disk controller, information concerning the activation of the spindle motor to enable the host system to acquire the information, when the activation of the spindle motor has failed, and the temperature of the spindle motor, measured by the temperature sensor, falls outside a predetermined temperature range in which the spindle motor can be activated, the information including a temperature control request used to cause the temperature of the spindle motor to fall within the predetermined temperature range, a present temperature of the spindle motor measured by the temperature sensor, and a waiting time required for the spindle motor to become activatable as a result of

temperature control by the host system, the present temperature of the spindle motor and the waiting time being required for the host system to report a non-functional state of the spindle motor to a user of the host system.

2. The disk drive apparatus according to claim 1, wherein the CPU determines that the temperature of the spindle motor falls outside the predetermined temperature range, if the temperature of the spindle motor, measured by the temperature sensor, is lower than a lower limit of the predetermined temperature range.

3. The disk drive apparatus according to claim 1, wherein the CPU determines that the temperature of the spindle motor falls outside the predetermined temperature range, if the temperature of the spindle motor, measured by the temperature sensor, is higher than a higher limit of the predetermined temperature range.

4. The disk drive apparatus according to claim 1, wherein the CPU estimates the waiting time on the basis of the present temperature of the spindle motor and a change per unit time in the temperature of the spindle motor.

5. The disk drive apparatus according to claim 1, wherein the CPU periodically sets, in the disk controller, updated information concerning the

activation of the spindle motor, during the time the temperature of the spindle motor falls outside the predetermined temperature range.

5 6. The disk drive apparatus according to claim 1, further comprising a nonvolatile memory which prestores the predetermined temperature range, the predetermined temperature range being inherent in a type of the spindle motor, and wherein the CPU compares the temperature of the spindle motor, measured by the temperature sensor, with the predetermined temperature range stored in the nonvolatile memory, thereby determining whether the temperature of the spindle motor falls outside the predetermined temperature range.

10 7. A disk drive apparatus with a spindle motor which rotates a disk medium, comprising:

 a motor driver configured to supply a current to the spindle motor to drive the spindle motor;

 a temperature sensor configured to measure
20 a temperature of the spindle motor;

 a heating/cooling unit configured to heat or cool at least the spindle motor;

 a disk controller connected to a host system which uses the disk drive apparatus, the disk controller
25 providing an interface control function which controls data communication between the host system and the disk drive apparatus; and

a CPU configured to control activation of the spindle motor using the motor driver,

wherein when the activation of the spindle motor has failed, and the temperature of the spindle motor, measured by the temperature sensor, falls outside
5 a predetermined temperature range in which the spindle motor can be activated,

the CPU causes the heating/cooling unit to heat or cool at least the spindle motor so as to make the
10 temperature of the spindle motor, measured by the temperature sensor, fall within the predetermined temperature range, and

the CPU sets, in the disk controller, information concerning the activation of the spindle motor to enable the host system to acquire the information,
15 the information including a present temperature of the spindle motor measured by the temperature sensor, and a waiting time required for the spindle motor to become activatable as a result of heating or cooling by the
20 heating/cooling unit, the present temperature of the spindle motor and the waiting time being required for the host system to report a non-functional state of the spindle motor to a user of the host system.

8. The disk drive apparatus according to claim 7,
25 wherein the CPU determines that the temperature of the spindle motor falls outside the predetermined temperature range, if the temperature of the spindle

motor, measured by the temperature sensor, is lower than a lower limit of the predetermined temperature range.

5 9. The disk drive apparatus according to claim 7, wherein the CPU determines that the temperature of the spindle motor falls outside the predetermined temperature range, if the temperature of the spindle motor, measured by the temperature sensor, is higher than a higher limit of the predetermined temperature range.

10 10. The disk drive apparatus according to claim 7, wherein the CPU estimates the waiting time on the basis of the present temperature of the spindle motor and a change per unit time in the temperature of the spindle motor.

15 11. The disk drive apparatus according to claim 7, further comprising a nonvolatile memory which prestores information indicative of a heating/cooling capacity of the heating/cooling unit, and wherein the CPU estimates
20 the waiting time on the basis of the temperature of the spindle motor measured by the temperature sensor, and the information stored in the nonvolatile memory and indicative of the heating/cooling capacity of the heating/cooling unit.

25 12. The disk drive apparatus according to claim 7, further comprising a nonvolatile memory which prestores a table in which the relationship between the

temperature of the spindle motor and the waiting time is entered, and wherein the CPU estimates the waiting time, referring to the table, on the basis of information concerning the temperature of the spindle motor measured by the temperature sensor.

13. The disk drive apparatus according to claim 7, wherein the CPU periodically sets, in the disk controller, updated information concerning the activation of the spindle motor, during the time the temperature of the spindle motor falls outside the predetermined temperature range.

14. The disk drive apparatus according to claim 7, further comprising a nonvolatile memory which prestores the predetermined temperature range, the predetermined temperature range being inherent in a type of the spindle motor, and wherein the CPU compares the temperature of the spindle motor, measured by the temperature sensor, with the predetermined temperature range stored in the nonvolatile memory, thereby determining whether the temperature of the spindle motor falls outside the predetermined temperature range.

15. A storage system comprising:

a disk drive with a spindle motor which is powered by a current supplied from a motor driver and rotates a disk medium;

a host system connected to the disk drive to use

the disk drive, and also connected to a heating/cooling unit, the heating/cooling unit capable of heating or cooling at least the disk drive; and

5 a display configured to display information output from the host system,

wherein the disk drive includes:

a temperature sensor configured to measure a temperature of the spindle motor;

10 a disk controller which provides an interface control function which controls data communication between the host system and the disk drive; and

15 a CPU configured to control activation of the spindle motor using the motor driver, the CPU setting, in the disk controller, information concerning the activation of the spindle motor to enable the host system to acquire the information, when the activation of the spindle motor has failed, and the temperature of the spindle motor, measured by the temperature
20 sensor, falls outside a predetermined temperature range in which the spindle motor can be activated, the information including a temperature control request used to cause the temperature of the spindle motor to fall within the predetermined temperature range,
25 a present temperature of the spindle motor measured by the temperature sensor, and a waiting time required for the spindle motor to become activatable as a result of

temperature control by the host system, the present temperature of the spindle motor and the waiting time being required for the host system to report a non-functional state of the spindle motor to a user of the host system,

and wherein the host system acquires, from the disk controller, the information concerning the activation of the spindle motor and set in the disk controller, the host system controlling the heating/cooling unit in accordance with the temperature control request contained in the information concerning the activation of the spindle motor, and also displaying, on the display, information which reflects the present temperature of the spindle motor and the waiting time, contained in the information concerning the activation of the spindle motor.

16. The storage system according to claim 15, wherein the CPU periodically sets, in the disk controller, updated information concerning the activation of the spindle motor, during the time the temperature of the spindle motor falls outside the predetermined temperature range.

17. The storage system according to claim 15, wherein the host system, the display and the heating/cooling unit are all installed in a vehicle.

18. The storage system according to claim 17, wherein the heating/cooling unit is an air conditioner

with a heating/cooling function capable of varying
an internal temperature of the vehicle.

19. A storage system comprising:

5 a disk drive with a spindle motor which is powered
by a current supplied from a motor driver and rotates
a disk medium;

a host system connected to the disk drive to use
the disk drive; and

10 a display configured to display information output
from the host system,

wherein the disk drive includes:

a temperature sensor configured to
measure a temperature of the spindle motor;

15 a heating/cooling unit configured to
heat or cool at least the spindle motor;

a disk controller which provides
an interface control function which controls data
communication between the host system and the disk
drive; and

20 a CPU configured to control activation
of the spindle motor using the motor driver,

wherein when the activation of the
spindle motor has failed, and the temperature of the
spindle motor, measured by the temperature sensor,
25 falls outside a predetermined temperature range in
which the spindle motor can be activated,

the CPU causes the heating/cooling unit

to heat or cool at least the spindle motor so as to make the temperature of the spindle motor, measured by the temperature sensor, fall within the predetermined temperature range, and

5 the CPU sets, in the disk controller, information concerning the activation of the spindle motor to enable the host system to acquire the information, the information including a present temperature of the spindle motor measured by the
10 temperature sensor, and a waiting time required for the spindle motor to become activatable as a result of heating or cooling by the heating/cooling unit, the present temperature of the spindle motor and the waiting time being required for the host system to
15 report a non-functional state of the spindle motor to a user of the host system,

 and wherein the host system acquires, from the disk controller, the information concerning the activation of the spindle motor and set in the disk
20 controller, the host system displaying, on the display, information which reflects the present temperature of the spindle motor and the waiting time, contained in the information concerning the activation of the spindle motor.

25 20. The storage system according to claim 19, wherein the CPU periodically sets, in the disk controller, updated information concerning the

activation of the spindle motor, during the time the temperature of the spindle motor falls outside the predetermined temperature range.

21. A method, used in a system including a disk drive with a spindle motor which rotates a disk medium, for displaying a non-functional state of the spindle motor when activation of the spindle motor has failed, the method comprising:

determining, when the activation of the spindle motor has failed, whether a temperature of the spindle motor falls outside a predetermined temperature range in which the spindle motor can be activated;

generating, in the disk drive, information concerning the activation of the spindle motor, when the temperature of the spindle motor falls outside the predetermined temperature range, the information including a temperature control request used to cause the temperature of the spindle motor to fall within the predetermined temperature range, a present temperature of the spindle motor measured by the temperature sensor, and a waiting time required for the spindle motor to become activatable as a result of temperature control by a host system which uses the disk drive;

acquiring, in the host system, the information concerning the activation of the spindle motor from the disk drive;

controlling, in the host system, a heating/cooling

unit in accordance with the temperature control request contained in the information, thereby at least heating or cooling the disk drive: and

5 displaying, in the host system, a non-functional state of the spindle motor on a display, the non-functional state reflecting the present temperature of the spindle motor and the waiting time contained in the information.

10 22. A method, used in a system including a disk drive with a spindle motor which rotates a disk medium, for displaying a non-functional state of the spindle motor when activation of the spindle motor has failed, the method comprising:

15 determining, when the activation of the spindle motor has failed, whether a temperature of the spindle motor falls outside a predetermined temperature range in which the spindle motor can be activated;

20 heating or cooling, when the temperature of the spindle motor falls outside the predetermined temperature range, at least the spindle motor by a heating/cooling unit installed in the disk drive, so as to make the temperature of the spindle motor fall within the predetermined temperature range, and generating, in the disk drive, information concerning
25 the activation of the spindle motor, the information including a present temperature of the spindle motor, and a waiting time required for the spindle motor to

become activatable as a result of heating or cooling by
the heating/cooling unit;

acquiring, in a host system which uses the disk
drive, the information concerning the activation of the
5 spindle motor from the disk drive; and

displaying, in the host system, a non-functional
state of the spindle motor on a display, the non-
functional state reflecting the present temperature of
the spindle motor and the waiting time contained in the
10 information.